Computer Basics

Number System
Moore’s Low
Motherboards

(1) Identifing the Computer

Number System:

- **Decimal**: 1234 = (1 x 1000)+ (2 x 100)+ (3 x 10)+ (4 x 1)

= $(1 \times 10^3)+ (2 \times 10^2)+ (3 \times 10^1)+ (4 \times l0^0)$

= 1000 + 200 + 30 + 4

= 1234

- **Binary**

Step	Binary Number	Decimal Number
Step 1	10101_2	$((1 \times 2^4) + (0 \times 2^3) + (1 \times 2^2) + (0 \times 2^1) + (1 \times 2^0))_{10}$
Step 2	10101_2	$(16 + 0 + 4 + 0 + 1)_{10}$
Step 3	10101_2	21_{10}

(1) Identifing the Computer

Number System:

- Octal

Octal was used in the early mainframe days.

Step	Octal Number	Decimal Number
Step 1	12570_8	$((1 \times 8^4) + (2 \times 8^3) + (5 \times 8^2) + (7 \times 8^1) + (0 \times 8^0))_{10}$
Step 2	12570_8	$(4096 + 1024 + 320 + 56 + 0)_{10}$
Step 3	12570_8	5496_{10}

(1) Identifing the Computer

Number System:

- Hexadecimal

Uses 10 digits and 6 letters, 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A (10), B(11), C(12), D(13), E(14), F(15).

Has a prefix with 0x

Step	Hex Number	Decimal Number
Step 1	$19FDE_{16}$	$((1 \times 16^4) + (9 \times 16^3) + (F \times 16^2) + (D \times 16^1) + (E \times 16^0))_{10}$
Step 2	$19FDE_{16}$	$((1 \times 16^4) + (9 \times 16^3) + (15 \times 16^2) + (13 \times 16^1) + (14 \times 16^0))_{10}$
Step 3	$19FDE_{16}$	$(65536 + 36864 + 3840 + 208 + 14)_{10}$
Step 4	$19FDE_{16}$	106462_{10}

(1) Identifing the Computer

Number System:

Hexadecimal

- Used in microprocessors and microcontrollers (Embedded system), process inputs by converting them into binary, store it, and display the same in hexanumbers again.
- Web development (ex: CSS colors)
- Networking (ex: MAC Address)
- In data science field, artificial intelligence and machine learning.

(1) Identifing the Computer

Number System:

- Binary to Decimal (vice versa)

50 / 2	= 25 : 0
25 / 2	= 12 : 1
12 / 2	= 6 : 0
6 / 2	= 3 : 0
3 / 2	= 1 : 1
1 / 2	= 0 : 1
110010	

1	+ 2*0 = 1
1	+ 2*1 = 3
0	+ 2*3 = 6
0	+ 2*6 = 12
1	+ 2*12 = 25
0	+ 2*25 = 50

(1) Identifing the Computer

Number System:

- Binary to Hexa (vice versa)

F (15)	= 1111
1	= 0001
b (11)	= 1011
111100011011	

(1) Identifing the Computer

ASCII Character Set:

- American Standard Code for Information Interchange
- Character encoding standard for electronic communication
- The first edition of the standard was published in 1963

https://en.wikipedia.org/wiki/ASCII

ASCII TABLE

Decimal	Hexadecimal	Binary	Octal	Char
0	0	0	0	*[NULL]*
1	1	1	1	*[START OF HEADING]*
2	2	10	2	*[START OF TEXT]*
3	3	11	3	*[END OF TEXT]*
4	4	100	4	*[END OF TRANSMISSION]*
5	5	101	5	*[ENQUIRY]*
6	6	110	6	*[ACKNOWLEDGE]*
7	7	111	7	*[BELL]*
8	8	1000	10	*[BACKSPACE]*
9	9	1001	11	*[HORIZONTAL TAB]*
10	A	1010	12	*[LINE FEED]*
11	B	1011	13	*[VERTICAL TAB]*
12	C	1100	14	*[FORM FEED]*
13	D	1101	15	*[CARRIAGE RETURN]*
14	E	1110	16	*[SHIFT OUT]*
15	F	1111	17	*[SHIFT IN]*
16	10	10000	20	*[DATA LINK ESCAPE]*
17	11	10001	21	*[DEVICE CONTROL 1]*
18	12	10010	22	*[DEVICE CONTROL 2]*
19	13	10011	23	*[DEVICE CONTROL 3]*
20	14	10100	24	*[DEVICE CONTROL 4]*
21	15	10101	25	*[NEGATIVE ACKNOWLEDGE]*
22	16	10110	26	*[SYNCHRONOUS IDLE]*
23	17	10111	27	*[ENG OF TRANS. BLOCK]*
24	18	11000	30	*[CANCEL]*
25	19	11001	31	*[END OF MEDIUM]*
26	1A	11010	32	*[SUBSTITUTE]*
27	1B	11011	33	*[ESCAPE]*
28	1C	11100	34	*[FILE SEPARATOR]*
29	1D	11101	35	*[GROUP SEPARATOR]*
30	1E	11110	36	*[RECORD SEPARATOR]*
31	1F	11111	37	*[UNIT SEPARATOR]*
32	20	100000	40	*[SPACE]*
33	21	100001	41	!
34	22	100010	42	"
35	23	100011	43	#
36	24	100100	44	$
37	25	100101	45	%
38	26	100110	46	&
39	27	100111	47	'
40	28	101000	50	(
41	29	101001	51	)
42	2A	101010	52	*
43	2B	101011	53	+
44	2C	101100	54	,
45	2D	101101	55	-
46	2E	101110	56	.
47	2F	101111	57	/
48	30	110000	60	**0**
49	31	110001	61	**1**
50	32	110010	62	**2**
51	33	110011	63	**3**
52	34	110100	64	**4**
53	35	110101	65	**5**
54	36	110110	66	**6**
55	37	110111	67	**7**
56	38	111000	70	**8**
57	39	111001	71	**9**
58	3A	111010	72	:
59	3B	111011	73	;
60	3C	111100	74	<
61	3D	111101	75	=
62	3E	111110	76	>
63	3F	111111	77	?
64	40	1000000	100	@
65	41	1000001	101	**A**
66	42	1000010	102	**B**
67	43	1000011	103	**C**
68	44	1000100	104	**D**
69	45	1000101	105	**E**
70	46	1000110	106	**F**
71	47	1000111	107	**G**
72	48	1001000	110	**H**
73	49	1001001	111	**I**
74	4A	1001010	112	**J**
75	4B	1001011	113	**K**
76	4C	1001100	114	**L**
77	4D	1001101	115	**M**
78	4E	1001110	116	**N**
79	4F	1001111	117	**O**
80	50	1010000	120	**P**
81	51	1010001	121	**Q**
82	52	1010010	122	**R**
83	53	1010011	123	**S**
84	54	1010100	124	**T**
85	55	1010101	125	**U**
86	56	1010110	126	**V**
87	57	1010111	127	**W**
88	58	1011000	130	**X**
89	59	1011001	131	**Y**
90	5A	1011010	132	**Z**
91	5B	1011011	133	[
92	5C	1011100	134	\
93	5D	1011101	135	]
94	5E	1011110	136	^
95	5F	1011111	137	_
96	60	1100000	140	`
97	61	1100001	141	**a**
98	62	1100010	142	**b**
99	63	1100011	143	**c**
100	64	1100100	144	**d**
101	65	1100101	145	**e**
102	66	1100110	146	**f**
103	67	1100111	147	**g**
104	68	1101000	150	**h**
105	69	1101001	151	**i**
106	6A	1101010	152	**j**
107	6B	1101011	153	**k**
108	6C	1101100	154	**l**
109	6D	1101101	155	**m**
110	6E	1101110	156	**n**
111	6F	1101111	157	**o**
112	70	1110000	160	**p**
113	71	1110001	161	**q**
114	72	1110010	162	**r**
115	73	1110011	163	**s**
116	74	1110100	164	**t**
117	75	1110101	165	**u**
118	76	1110110	166	**v**
119	77	1110111	167	**w**
120	78	1111000	170	**x**
121	79	1111001	171	**y**
122	7A	1111010	172	**z**
123	7B	1111011	173	{
124	7C	1111100	174	|
125	7D	1111101	175	}
126	7E	1111110	176	~
127	7F	1111111	177	*[DEL]*

(1) Identifing the Computer

Moore’s Low

- In 1965, by Gordon Moore - the co-founder of Intel

- Is the observation that the number of transistors in a dense integrated circuit doubles about every two years.

- Experts agree that computers should reach the physical limits of Moore's Law at some point in the 2020s.

- Intel's Core i7 microprocessor has 731 million transistors

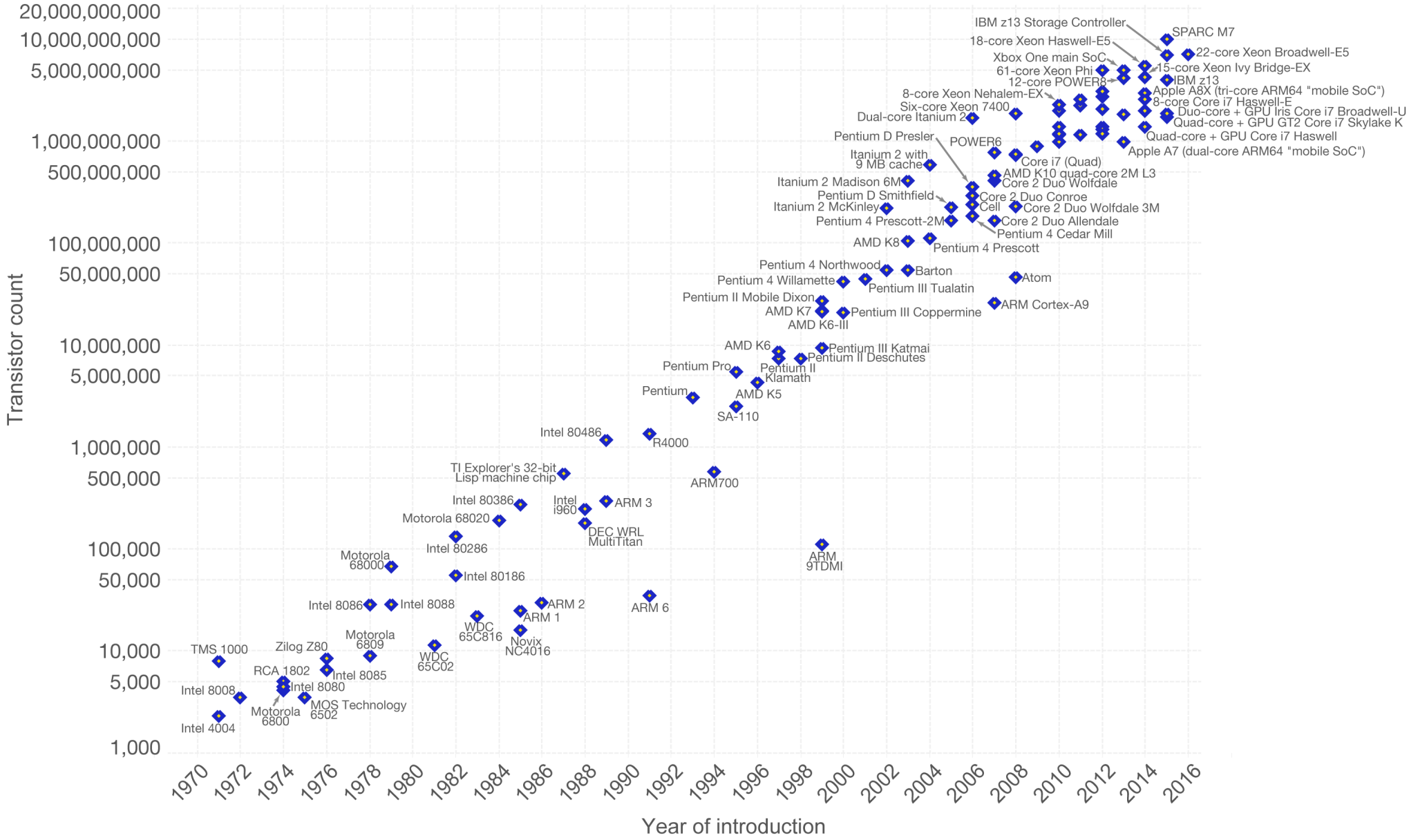
- Xeon processor has 1.9 billion transistors

https://www.intel.com/pressroom/kits/quickreffam.htm

Moore's Law – The number of transistors on integrated circuit chips (1971-2016)

Our World in Data

Moore's law describes the empirical regularity that the number of transistors on integrated circuits doubles approximately every two years. This advancement is important as other aspects of technological progress – such as processing speed or the price of electronic products – are strongly linked to Moore's law.



Data source: Wikipedia (https://en.wikipedia.org/wiki/Transistor_count)

The data visualization is available at OurWorldinData.org. There you find more visualizations and research on this topic.

(2) Inside The Box: MotherBoards

- Mainboard, System Board, Main Circuit Board, Baseboard, Planar Board or Logic Board

- The motherboard is the spine of the computer

- It is the printed circuit board (PCB) that holds your RAM, processor, and a number of other components in place.

- If you take a close look at the system board, you can see that there are wires embedded on the board that form little pathways that span the system. This connection allows information to travel from one component to another component.

(2) Inside The Box: MotherBoards

Types of Motherboards:

Integrated system boards

Are called that because most of the components such as Graphic cards are integrated into the motherboard circuitry.

Advantages:

Integrated system boards were designed for their simplicity. Cheaper to produce.

Disadvantages:

When one component breaks, you can't just replace the component that's broken; the whole motherboard must be replaced.

Non-integrated system boards

Are called that because most of the components such as music cards are installed in the computer as expansion cards.

Advantages:

Cheaper to repair, Easier to Upgrade

MotherBoard

1) System Board Form Factors

It is important to understand the different motherboard form factors (design), because you cannot take any motherboard and place it in a computer case. You must put an ATX board in an ATX case,

- AT
- ATX
- ITX

MotherBoard

1) System Board Form Factors

- XT, released in 1983 by IBM

MotherBoard

1) System Board Form Factors

- AT (Advanced Technology), in 1984 by IBM

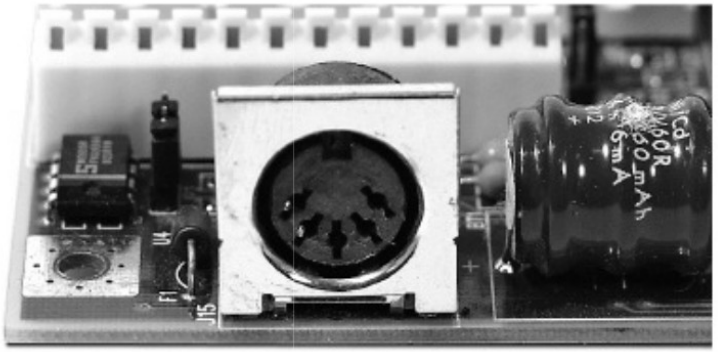
- The processor slot or socket and memory sockets are located at the front of the motherboard with longer expansion cards to extend over them.

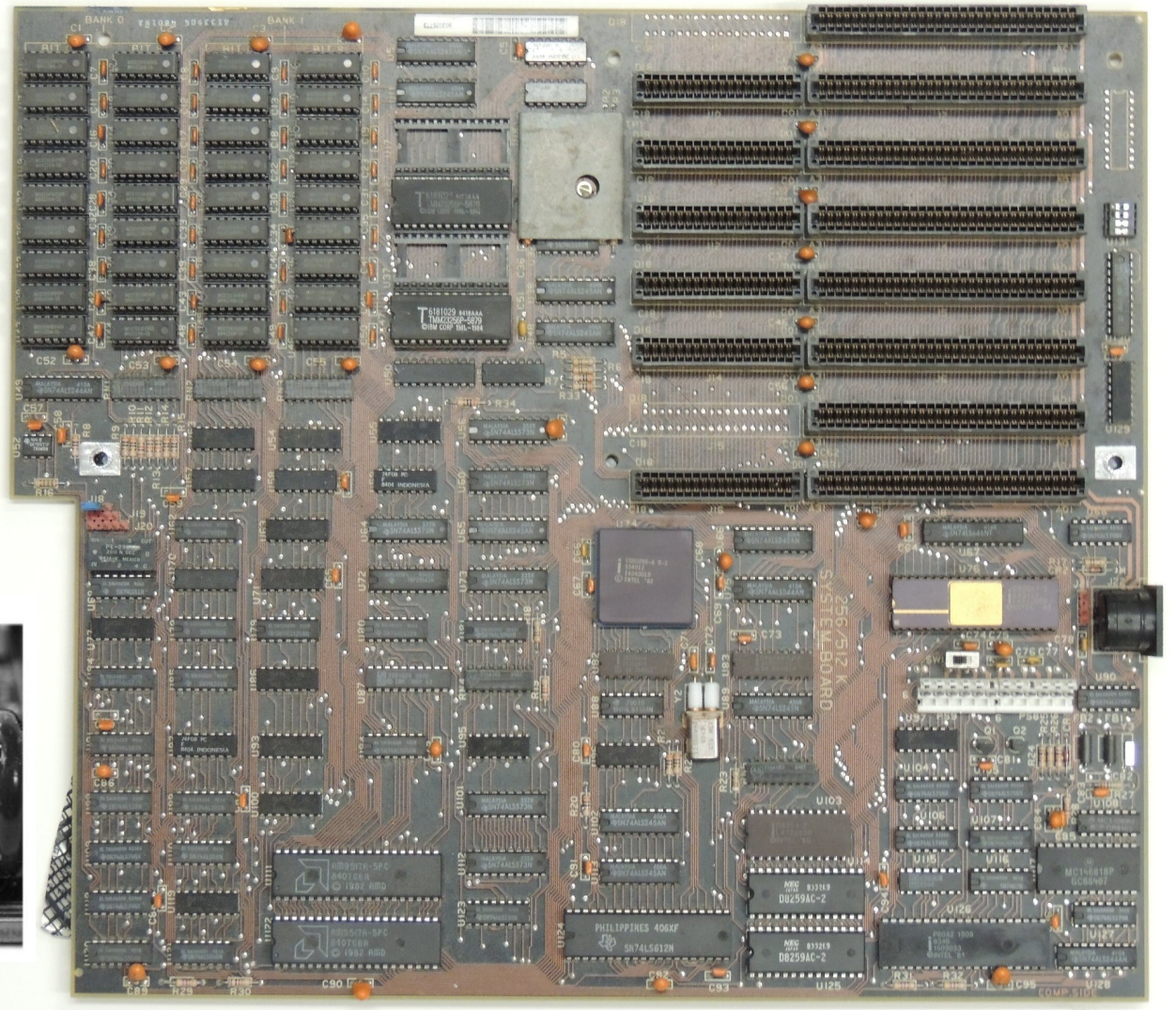
The AT suffered:

- From a problem with accessing some of the items on the motherboard for example troubleshooting of the components on the motherboard is very difficult

- From overheating because of the expansion cards,once inserted into the systems.

MotherBoard





AT Board

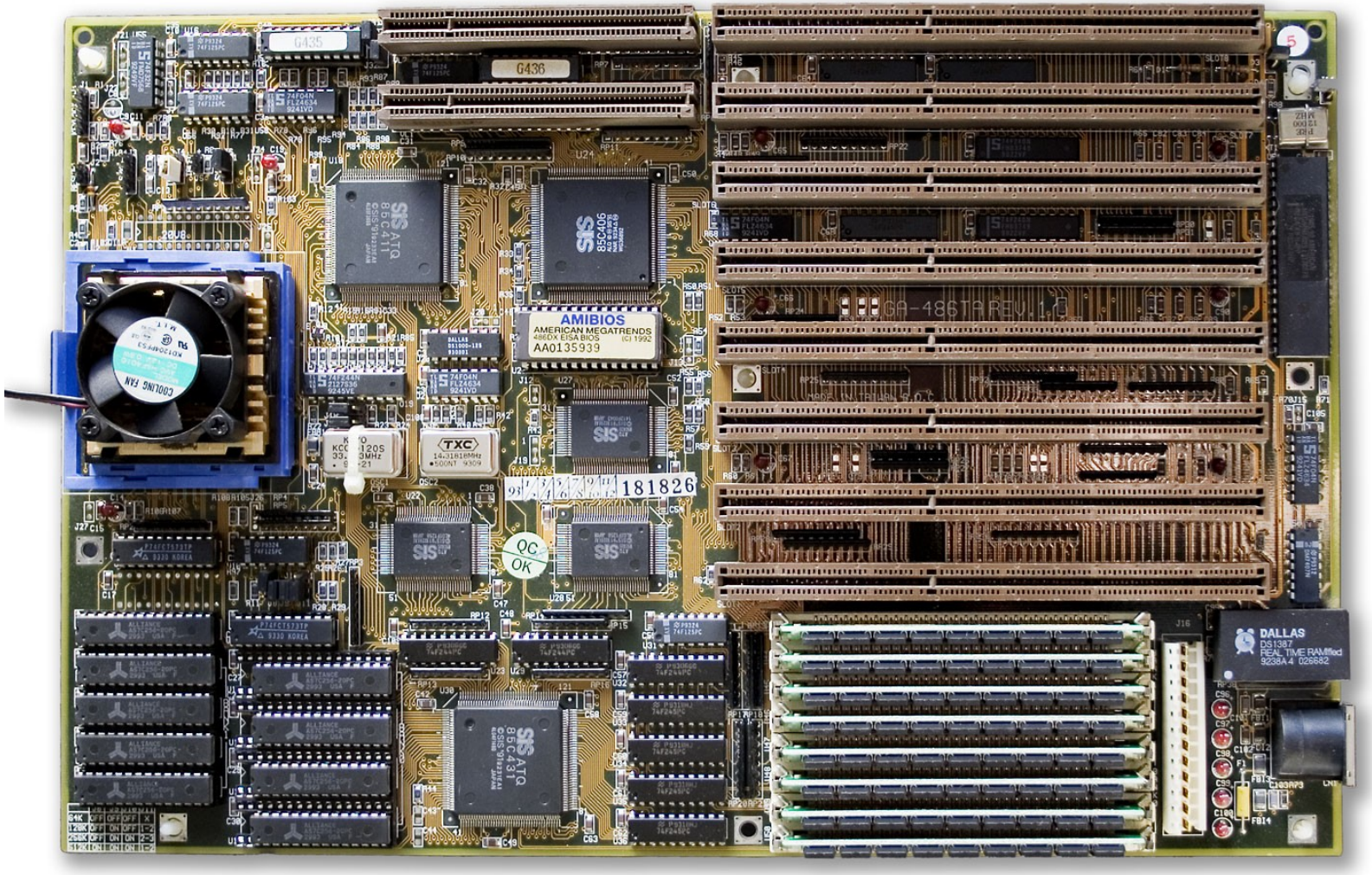
MotherBoard

1) System Board Form Factors

- Baby AT, In 1985 by IBM

- Used for 486 and Pentium processors.
- The processor slot or socket and memory sockets are located at the front of the motherboard.
- The baby AT board usually had a mixture of ISA and PCI slots located on the system board and included a plug and play BIOS.
- Using of SIMM and DIMM slots.
- The Baby AT board introduced a 60/66 MHz system bus.
- PS/2 mouse connector.

MotherBoard



Baby AT

MotherBoard

1) System Board Form Factors

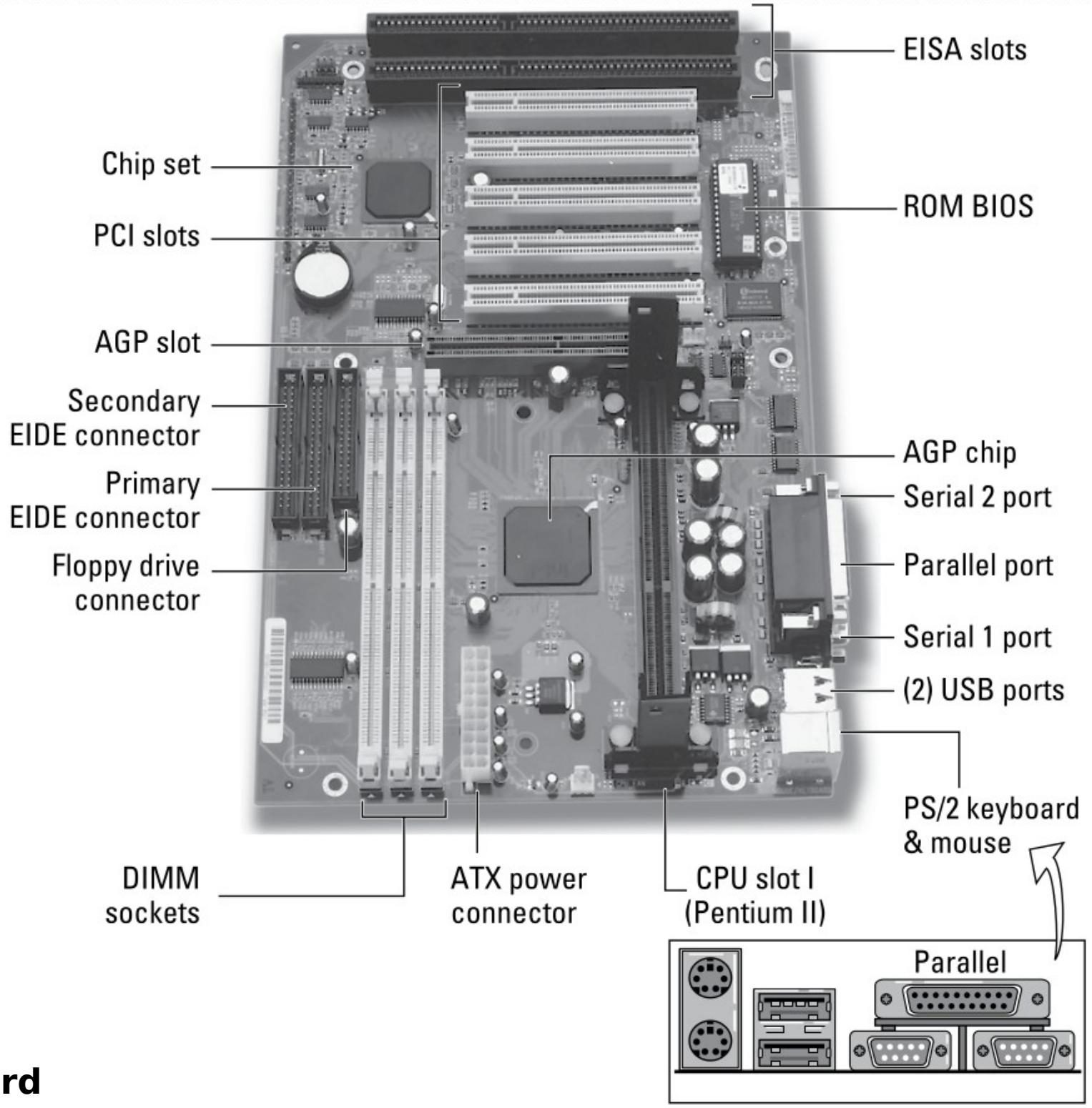
- ATX (Advanced Technology Extended) in 1995 by INTEL

- The ATX has the processor and memory slots at right angles to the expansion cards

- Integrated I/O port connectors directly into the board, including USB ports.

- The ATX board introduced a 100 MHz system bus and has been increased to speeds of 533 MHz and higher.

- Soft power support (3.3v), which meant that the system could be shut down by the operating system.


EISA slots
Chip set
ROM BIOS
PCI slots
AGP slot
Secondary EIDE connector
AGP chip
Serial 2 port
Primary EIDE connector
Parallel port
Floppy drive connector
Serial 1 port
(2) USB ports
PS/2 keyboard & mouse
DIMM sockets
ATX power connector
CPU slot I (Pentium II)
Parallel

ATX Board

MotherBoard

1) System Board Form Factors

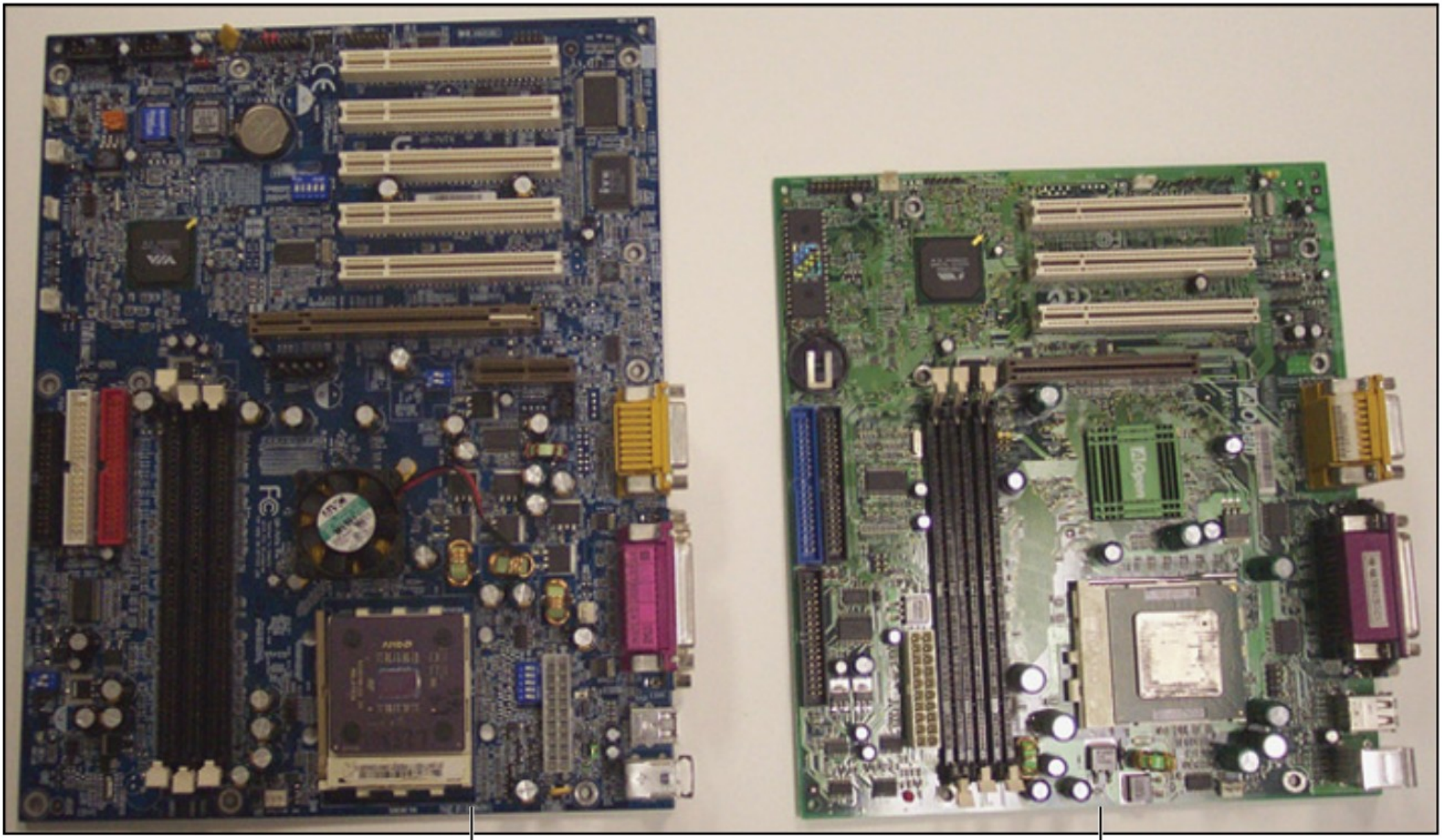
- MicroATX and FlexATX

- Smaller versions of the ATX motherboard.

- is 9.6" x 9.6" and can fit in either a microATX case or a normal ATX case, known as a full ATX case.

- Measuring 9" x 7.5", the FlexATX is smaller than the microATX but can fit in an ATX or a microATX case.

1 inch = 2.54 cm = 25.4 mm



ATX motherboard

microATX motherboard

MotherBoard

1) System Board Form Factors

- ITX

- Was developed by VIA Technologies in 2001

- ITX has different dimensions and is designed to function in different devices

- **Mini-ITX:** A low-power motherboard form factor that is smaller than the microATX with dimensions of 6.7 x 6.7 inches. Because of their low power consumption, they are kept relatively cool and are typically used in home theater PCs.

- **Nano-ITX:** The Nano-ITX form factor was developed in 2005 and has dimensions of 4.7 x 4.7 inches. The Nano-ITX form factor is a low-power-consumption form factor as well and is used in devices such as PVRs, media centers, and car PCs.

- Mobile-ITX: The Mobile-ITX form factor (2009) is used for compact devices such as smartphones, with dimensions such as 75mm x 45mm.

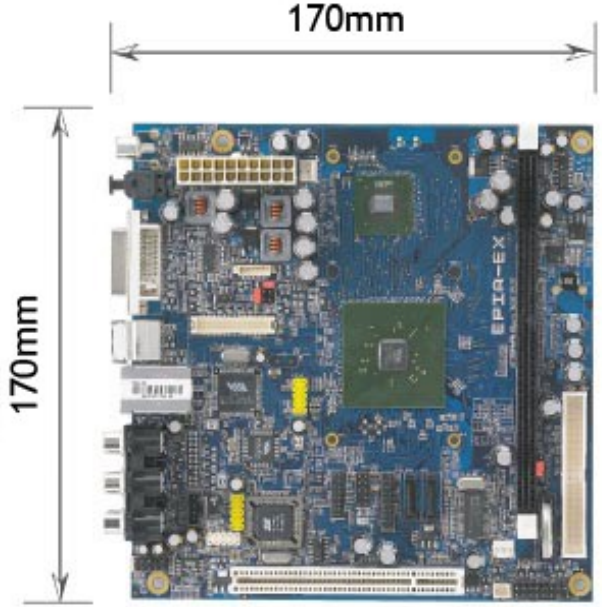
Standard-ATX

Micro-ATX

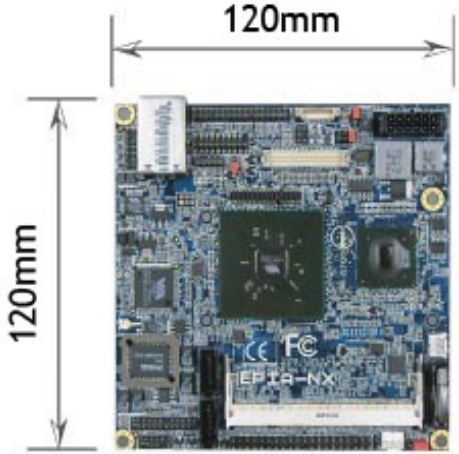
Mini-ITX

Nano-ITX

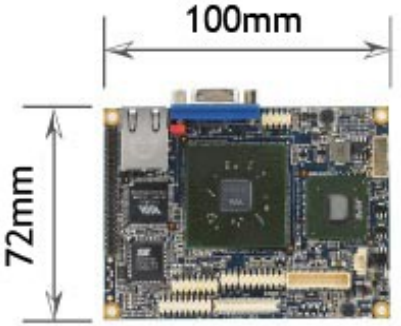
Pico-ITX



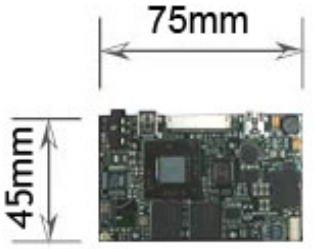
Mini-ITX



Nano-ITX



Pico-ITX



Mobile-ITX

MotherBoard

1) System Board Form Factors

- BTX (Balanced Technology eXtended)

- Designed by INTEL to replace the ATX form factor in late 2004 - early 2005 and create smaller, low-profile systems

- The BTX layout establishes a straighter path of airflow with fewer obstacles, resulting in better overall cooling capabilities.

- Future development of BTX retail products by Intel was canceled in September 2006 following Intel's decision to refocus on low-power CPUs after suffering scaling and thermal issues with the Pentium 4

Specification	Year	Dimensions of motherboard	Expansion slots
BTX	2004	10.5 × 12.8 in (266.70 × 325.12 mm)	7
micro BTX		10.5 × 10.4 in (266.70 × 264.16 mm)	4
nano BTX		10.5 × 8.8 in (266.70 × 223.52 mm)	2
pico BTX		10.5 × 8.0 in (266.70 × 203.20 mm)	1

MotherBoard

2) System Board Components

- **Chipsets**
- **Expansion slots and buses**
- Memory slots and external cache
- CPUs and their sockets
- Power connectors
- Onboard disk drive connectors
- Keyboard connectors
- **Integrated peripheral ports and headers**
- BIOS/firmware
- CMOS battery
- **Jumpers and DIP switches**
- **Front-panel connectors**

Thanks For Attention